Standing Waves

wave function: $y(x,t) = 2A\cos(wt)\sin(wt)$

nodes: $x_{\text{node}} = \dfrac{n}{2}l$

antinodes: $x_{\text{antinode}} = \dfrac{2n+1}{4}l$

Resonant Waves on a String

If the string is tied on both ends, there are nodes on both ends.

If L is the length of the string, then $L = n\dfrac{l}{2}$.

Waves with wavelengths $l_n = \dfrac{2L}{n}$ and frequencies $f_n = \dfrac{nv}{2L}$
are called **normal modes** (or n-th harmonics). The normal mode
with $n = 1$ is called the **fundamental mode** or first harmonic.

For a wave on a string, the phase velocity is $v = \sqrt{\dfrac{F}{m}}$, therefore

the normal modes have frequencies $f_n = \dfrac{n}{2L}\sqrt{\dfrac{F}{m}}$.